PTO 05-5954

German Patent No. 40 16 922 A1
(Offenlegungsschrift)

ELECTRICAL TWO-WIRE MEASURING TRANSDUCER

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UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. SEPTEMBER 2005
TRANSLATED BY THE MCELROY TRANSLATION COMPANY

FEDERAL REPUBLIC OF GERMANY
GERMAN PATENT OFFICE
PATENT NO. 40 16 922 A1
(Offenlegungsschrift)

Int. Cl.^{5}:	G 01 D 5/14, G 01 R 19/25, G 01 K 7/00, G 01 L 13/00, G 01 R 19/08
Filing No.:	P 40 16 922.7
Filing Date:	May 25, 1990
Date Laid-open to Public Inspection:	November 28, 1991

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[Prüfungsantrag gem. § 44 PatG ist gestellt]

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Description

[001] The invention pertains to an electrical two-wire measuring transducer according to the preamble of the claim.

[002] A measuring transducer of this type is known from the publication "User's Manual: Model 3051C-Smart Pressure Transmitter" of the firm Rosemount, August 1988, Publication Number 4622/4623. Figure 9-2 on page 9-1 of this publication shows a block diagram of a transducer for measuring differential pressures that operates in accordance with the two-wire principle. The transducer for measuring differential pressures contains a sensor that transforms the differential pressure to be measured and the temperature of the sensor into corresponding electric signals. These electric signals are converted into digital signals by an analog/digital converter and fed to an electronic circuit with a microprocessor. The

microprocessor controls the signal combinations of the measuring transducer and simultaneously carries out calculations for linearizing the sensor and for adjusting the measuring range, as well as the communication with an external communication unit. The digital/analog converter converts the digital signals of the microprocessor into a 4_20 mA signal that is conventionally fed to a control room via a two-wire line. The microprocessor exchanges digital data with an external communication unit. The data exchange is realized by means of high-frequency signals with the 4_20 mA signal superimposed thereon in such a way that its mean value is not compromised. The design of such measuring transducers represents a compromise between a high processing speed on one hand and a low energy requirement of the circuit components on the other hand. In other words, a limitation of the maximum energy supplied to the measuring transducer restricts the processing speed of the microprocessor. This leads to the output signals of the measuring transducer being unable to immediately follow rapid changes of the parameter to be measured.

[003] The invention is based on the objective of developing a measuring transducer of the initially cited type, the continuously delivered output signal of which is also able to follow rapid changes of the parameter to be measured without interruptions.

[004] According to the invention, this objective is attained with the characteristics disclosed in the characterizing portion of the claim. The processing of measuring values for dynamic processes takes place on the analog transmission path only. The processor merely carries out corrective interventions on the analog transmission path. The configuration of the measuring transducer and the communication with external auxiliary devices or computers takes place via the digital transmission path without interrupting the transmission of the measuring values. The invention makes it possible to realize low clock frequencies for the processor and the analog/digital converter and therefore a low current consumption.

[005] Other characteristics of the invention are described in greater detail below with reference to the embodiments illustrated in the enclosed figures. The figures show:

[006] Figure 1, a block diagram of a first transducer for measuring differential pressures according to the invention, and

[007] Figure 2, a block diagram of another transducer for measuring differential pressures according to the invention.

[008] Identical components are identified by the same reference symbols in both figures.

[009] Figure 1 shows a block diagram of a first transducer for measuring differential pressures according to the invention. A sensor 1 determines the differential pressure dp to be measured, the static pressure p acting upon the sensor 1 as well as the temperature T of the sensor 1 and converts these parameters into corresponding analog signals. These output signals of the sensor 1 are fed to the inputs of three analog/digital converters 5.1, 5.2 and 5.3 via lines 2, 3 and 4. The output signal of the sensor 1 that corresponds to the differential pressure dp is also fed to the first input of a combinatorial circuit 6. The outputs of the analog/digital converters 5.1, 5.2 and 5.3 are connected to a processor circuit 7. The processor circuit 7 calculates two digital correction signals for the analog signal corresponding to the differential pressure dp from the digitized output signals of the sensor 1.

[010] A first digital/analog converter 8 converts the first digital correction signal into a first analog correction signal. The first analog correction signal is fed to the second input of the combinatorial circuit 6 via a line 9. A second digital/analog converter 10 converts the second digital correction signal into a second analog correction signal, wherein the second analog correction signal is fed to the third input of the combinatorial circuit 6 via a line 11. The combinatorial circuit 6 combines the analog signal corresponding to the differential pressure dp with the first analog correction signal fed to the combinatorial circuit 6 via the line 9, namely in the form of a summation for assessing the operational sign. In addition, the combinatorial circuit 6 carries out a multiplicative combination of the analog signal corresponding to the

differential pressure dp and the second analog correction signal fed to the combinatorial circuit 6 via the line 11. If the quality of the correction is not subject to very strict requirements, it would also be conceivable to utilize the first or the second analog correction signal only. In this case, the correction of the analog signal corresponding to the differential pressure dp is either carried out in the form of a summation for assessing the operational sign or in the form of a multiplicative combination. The output of the combinatorial circuit 6 is connected to the input of an amplifier circuit 12 that transforms the output signal of the combinatorial circuit 6 into a load-independent current. The amplifier circuit 12 is connected in series to a measuring transducer interface 13. The measuring transducer interface 13 combines the analog transmission path of the measuring transducer consisting of the combinatorial circuit 6 and the amplifier circuit 12 with the digital transmission path of the measuring transducer consisting of the processor circuit 7. The measuring transducer interface is conventionally connected to a control room that is not illustrated in the figures via a two-wire line 14, wherein the parameter to be measured is displayed in said control room. The communication with the processor circuit 7 is realized by means of a not-shown communication interface that is connected to the two-wire line 14. The analog transmission path for the output signal of the sensor 1 that corresponds to the differential pressure dp consists of the combinatorial circuit 6, the amplifier circuit 12 and the measuring transducer interface 13. The output current flowing through the two-wire line 14 immediately follows changes in the differential pressure dp.

[011] Figure 2 shows a block diagram of a second transducer for measuring differential pressures according to the invention. Components of this measuring transducer that correspond to the measuring transducer shown in Figure 1 are identified by the same reference symbols as in Figure 1. In addition to the measuring transducer shown in Figure 1, an arithmetic element 15 with square root law transfer characteristics is arranged between the combinatorial circuit 6 and the amplifier circuit 12. The arithmetic element 15 transforms the received analog input signals into pulse-width modulated intermediate signals, the pulse width ratio of which represents a quantity for the square root of the input signal. An integrator contained in the arithmetic element 15 may simply consist of an RC element and forms the

arithmetic mean of the pulse-width modulated intermediate signal. The output signal of the integrator contained in the arithmetic element 15 is fed to the amplifier circuit 12 in the form of an analog input signal. The analog signal with the square root extracted is digitized by enumerating the pulse width ratio of the pulse-width modulated intermediate signal with pulses that have a higher frequency than that of the intermediate signal. The digitized output signal of the arithmetic element 15 represents a quantity for the differential pressure dp acting upon the sensor 1. This signal is fed to the processor circuit 7 via the data line 16. This means that the analog/digital converter 5.3 for digitizing the analog signal corresponding to the differential pressure dp in the measuring transducer according to Figure 1 can be eliminated in the measuring transducer shown in Figure 2. Analogous to the previously described embodiment, the output current flowing through the two-wire line 14 immediately follows changes in the differential pressure dp.

[012] In contrast to the embodiment shown in Figure 2, the arithmetic element 15 may, if so required, also have linear transfer characteristics rather than square root law transfer characteristics. In this case, the arithmetic element 15 transforms the received analog input signal into a pulse-width modulated intermediate signal, the pulse width ratio of which is proportional to the input signal. This pulse-width modulated intermediate signal is then additionally processed by forming the arithmetical mean value and enumerating the pulse-width ratio in accordance with the above-described embodiment.

Claim

An electrical two-wire measuring transducer, with a sensor for the parameter to be measured, with an electronic circuit that is connected in a series to said sensor and transforms the output signal of the sensor into a load-independent output current, the intensity of which represents a quantity for the parameter to be measured, and with a processor circuit that corrects the output signal of the sensor in accordance with predetermined criteria and also exchanges digital data with an external communication unit, wherein the data transmission between the processor circuit and the communication unit is realized by means of high-frequency signals on which the load-independent output current is superimposed, characterized by the fact

-that the measuring transducer has an analog and a digital transmission path, by the fact

-that the analog transmission path serves as the main transmission path, wherein the interconnection and transformation of the sensor output signal into the load-independent output current is realized on the analog transmission path, and by the fact

-that the correction values calculated by the processor circuit are combined with the analog output signal of the sensor after a conversion into analog signals.

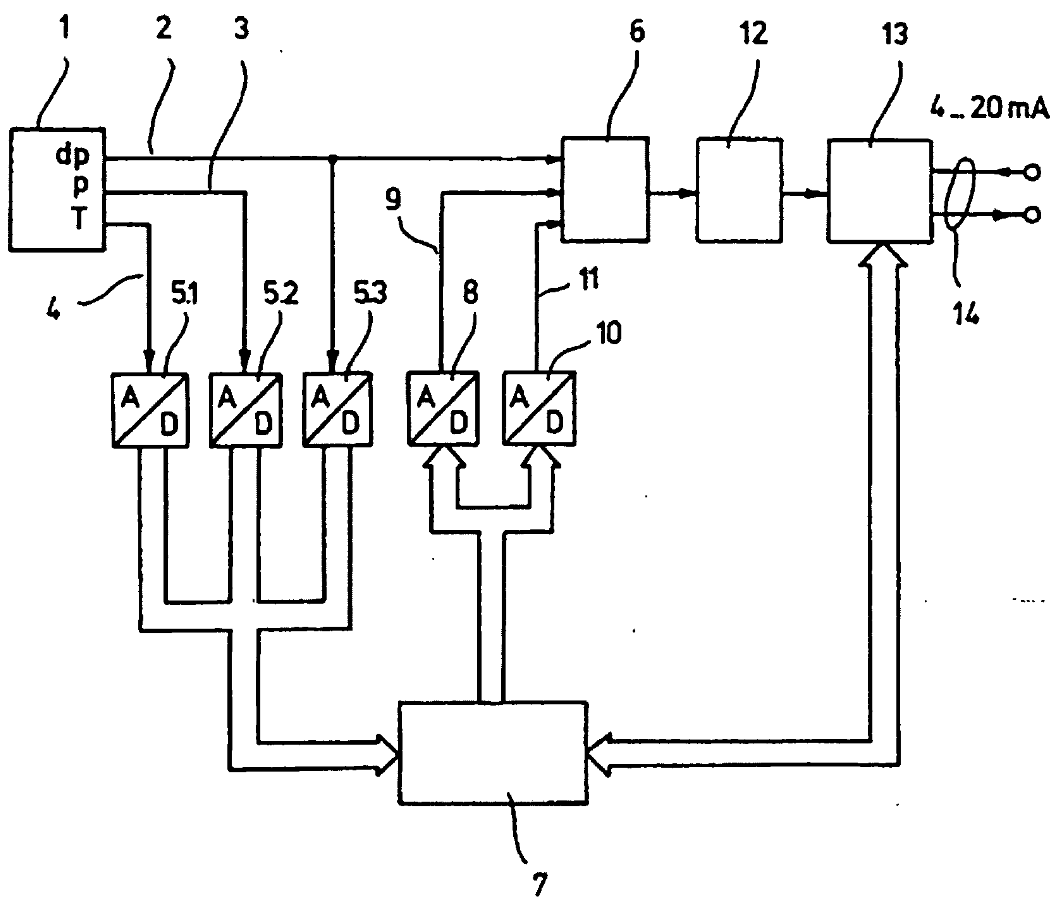

Fig. 1

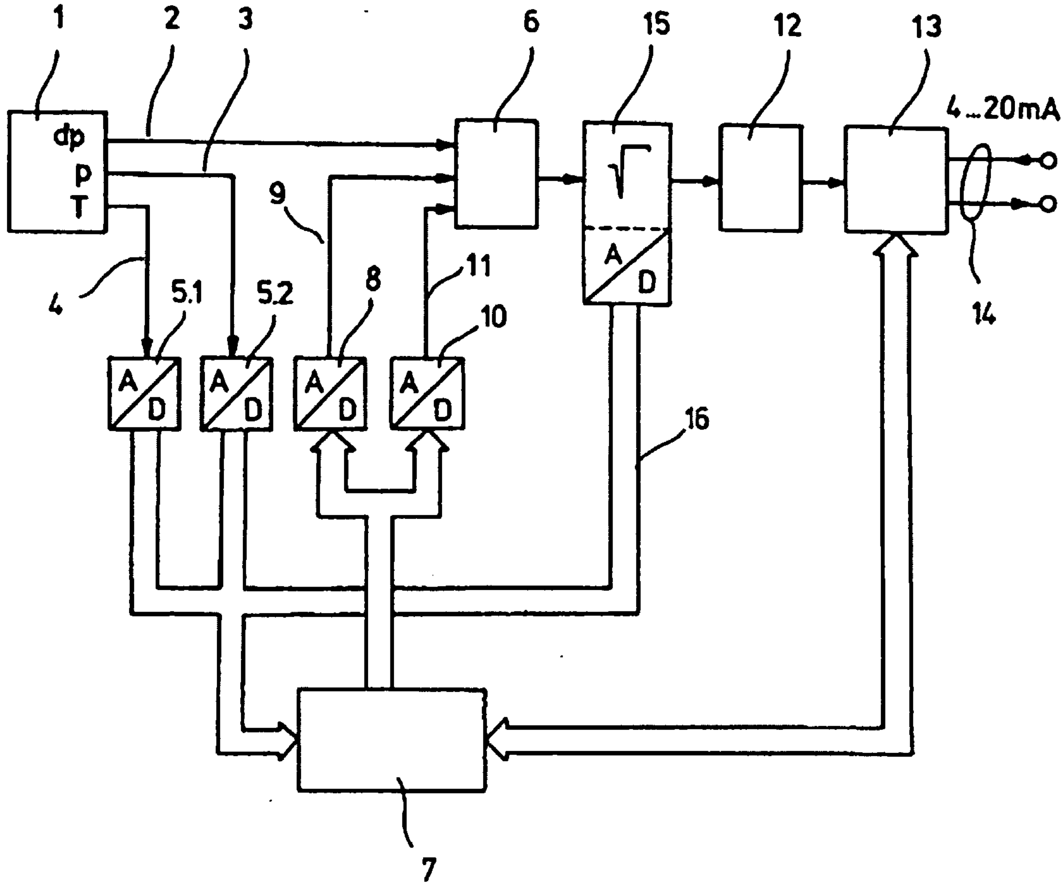

Fig. 2